What is claimed is:

sub A1 1. A centrifuge for accepting an input mixture and for separating a light material that is within the mixture from a heavy material that is within the mixture, comprising:

a housing having a central member rotatable on an axis of rotation and at least one arm assembly, said at least one arm assembly having,

an outer tube having a first end operably connected to said central member, and a closed second end extending away from said central member;

an intermediate tube operably connected to said central member, said intermediate tube located within said outer housing defining a first annular flow path between said outer housing and said intermediate tube; and

an inner tube operably connected to said central member, said inner tube located within said intermediate tube defining a second annular flow path between said intermediate tube and said inner tube and a tubular flow path within said inner tube;

an input mixture flow path for receiving said input mixture, said input mixture flow path formed in said housing and communicating with one of said first and second annular flow paths;

a light material flow path communicating with other of said first and second annular flow paths; and

a heavy material flow path communicating with said tubular flow path.

2. The centrifuge of claim 1 wherein said at least one arm assembly is rotatable in a plane that extends generally perpendicular to said axis of rotation.

3. The centrifuge of claim 1 wherein said axis of rotation is substantially horizontal.

4. The centrifuge of claim 1 wherein one half of said housing is located below ground level.

5. The centrifuge of claim 1 wherein said outer tube further comprises an outer housing and a removable end plug connected to said outer housing at said second end.

6. The centrifuge of claim 1 further comprising a first mounting ring operably connecting said outer tube to said central member.

7. The centrifuge of claim 6 further comprising a second mounting ring operably connecting said intermediate tube to said central member and said first mounting ring.

8. The centrifuge of claim 7 further comprising a third mounting ring operably connecting said inner tube to said central member and said second mounting ring.

9. The centrifuge of claim ~~9~~ 8 wherein said first mounting ring includes an overhanging portion that overlies a portion of said second mounting ring, and wherein said second mounting ring includes and overhanging portion that overlies a portion of said third mounting ring.

10. The centrifuge of claim 1 further comprising a conveyor screw located within said inner tube of said arm assembly to facilitate passage of said heavy material through said tubular flow path.

11. The centrifuge of claim 1 further comprising a first motor for driving said central member and a drive shaft operably connecting said first motor to said central member.

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12. The centrifuge of claim 10 further comprising a second motor operably connected to said conveyor screw for driving said conveyor screw.

13. The centrifuge of claim 11 wherein said first motor is an electric motor.

14. The centrifuge of claim 12 wherein said second motor is a hydraulic motor.

15. The centrifuge of claim 11 further comprising a second motor operably connected to said conveyor screw for driving said conveyor screw.

16. The centrifuge of claim 15 wherein the speed of said first motor is variable independently from the speed of said second motor.

17. The centrifuge of claim 11 wherein said drive shaft is hollow and is in communication with said input mixture flow path such that input mixture is fed from said drive shaft through said central member and into one of said first and second annular flow paths.

18. The centrifuge of claim 1 further comprising:

a heavy material output cavity formed in said central member;

a heavy material discharge cone having an apex-end thereof associated with said heavy material cavity, said discharge cone being formed about an axis that is generally coincident with said axis of rotation.

19. The centrifuge of claim 18 wherein said light material flow path is formed in a wall of said discharge cone.

20. The centrifuge of claim 18 wherein said drive shaft and said discharge cone extend in opposite directions away from said central member.

21. The centrifuge of claim 18 further comprising:

a small size annular housing surrounding a base portion of said discharge cone and receiving said heavy material from said discharge cone; and

an intermediate size annular housing surrounding an intermediate portion of said discharge cone and receiving said light material from said light material flow path formed in said wall of said discharge cone.

22. The centrifuge of claim 14 further comprising:

an input hydraulic line and an output hydraulic line in coaxial relation to one another connected to said hydraulic motor.

Sub A2 23. A centrifuge for accepting an input mixture and for separating a light material that is within the mixture from a heavy material that is within the input mixture, comprising:

a central member rotatable on an axis of rotation;

a first arm assembly mounted on one side of said central member;

a second arm assembly mounted on an opposite side of said central member;

said first and second arm assemblies rotatable in a plane that extends generally perpendicular to said axis of rotation;

each of said first and second arms having;

an outer housing having a closed outer end and an inner end mounted to said central member;

an intermediate tube having an open outer end and an inner end mounted to said central member;

an inner tube having an open outer end and an inner end mounted to said central member;

said outer housing, intermediate tube and inner tube being concentrically arranged;

said inner tube having a given length;

said intermediate tube having a length that is less than said given length; and

said outer end of said outer housing being physically spaced from said outer end of said intermediate tube and from said outer end of said inner tube;

an input mixture flow path communicating with a cylindrical space between said intermediate tube and said inner tube;

a heavy material flow path communication with a space within said inner tube;

a light material flow path communication with a cylindrical space between said intermediate tube and said outer housing;

a first conveyer screw located within said inner tube of said first arm assembly;

a second conveyer screw located within said inner tube of said second arm assembly;

first drive means connected to effect rotation of said body member and said first and second arm assemblies about said axis of rotation; and

second speed controllable drive means connected to effect rotation of said first and second conveyer screws.

24. The centrifuge of claim 23 including:

an input mixture cavity formed within said central member;

said input mixture cavity communicating with said cylindrical space between said intermediate tube and said inner tube;

a hollow drive shaft centered on said axis of rotation and coupled to said first drive means, said drive shaft for receiving said input mixture and connected to said input mixture cavity;

a heavy material output cavity formed in said central member, said heavy material output cavity communicating with said space within said inner tube; and

a light material flow path formed in said central member, said light material flow path communicating with said cylindrical space between said intermediate tube and said outer housing.

25. The centrifuge of claim 24 further comprising a heavy material discharge cone having an apex associated with said heavy material cavity, said discharge cone being formed about an axis that is generally coincident with said axis of rotation.

26. The centrifuge of claim 25 wherein said light material flow path is formed in a wall of said discharge cone.

27. The centrifuge of claim 26 wherein said drive shaft and said discharge cone extend in opposite directions away from said body member.

28. The centrifuge of claim 26 further comprising:

a first housing surrounding said first and second arm assemblies;

a small size annular housing surrounding a base portion of said discharge cone and receiving heavy material from said discharge cone; and

an intermediate size annular housing surrounding an intermediate portion of discharge cone and receiving light material from said light material flow path formed in said wall of said discharge cone.

29. The centrifuge of claim 23 wherein said first drive means is a speed controllable electric motor and wherein said second drive means is a hydraulic motor.

30. The centrifuge of claim 29 wherein said hydraulic motor is mounted within said heavy material output cavity.

31. The centrifuge of claim 30 further comprising an input hydraulic line and an output hydraulic line connected to said hydraulic motor and extending coextensive with said axis of rotation.

32. A method of using a centrifuge to separate a light material that is within an input mixture from a heavy material that is within the input mixture, while at the same time independently controlling a speed of rotation of the centrifuge and a speed of removal of the heavy material from the centrifuge, comprising the steps of:

providing a first and a second arm assembly aligned on an arm-axis and that are rotatable in a plane extending generally perpendicular to a rotation-axis;

providing that each of said first and second arm assemblies includes a tubular-housing having a closed outer end, an intermediate tube having an open outer end, and an inner tube having an open outer end;

providing that said inner tube of each arm assembly is of a given length;

providing that said intermediate tube of each arm assembly is of a length that is less than said given length;

providing that an outer end of said tubular-housing of each arm assembly is spaced from said outer end of said intermediate tube and from said outer nd of said inner tube;

providing an input mixture flow path that communicates with a cylindrical space between said intermediate tube and said inner tube of each arm assembly;

providing a heavy material flow path that communicates with a space within said inner tube of each arm assembly;

providing a light material flow path that communicates with a cylindrical space between said intermediate tube and said tubular-housing of each arm assembly;

providing a conveyer screw within the inner tube of each arm assembly;

providing first speed controllable drive means connected to effect rotation of said first and second arm assemblies about said rotation-axis; and

providing second speed controllable drive means connected to effect rotation of said conveyer screws.

33. The method of claim 32 wherein said first speed-controllable drive means is an electric motor and wherein said second speed-controllable drive means is a hydraulic motor.

34. The method of claim 33 wherein said rotation-axis extends in a horizontal direction.

35. In a centrifuge wherein a light material within an input mixture is separated from a heavy material within the input mixture, the centrifuge including a first and a second axially aligned arm assembly rotatable in a plane that extends generally perpendicular to an axis of rotation, wherein each of the first and second arm assemblies includes a tubular-housing having a closed outer end, an intermediate tube having an open outer end, and an inner tube having an open outer end, wherein the inner tube of each arm assembly is of a given length, wherein the intermediate tube of each arm assembly is of a length that is less than the inner tube, wherein the

outer end of the tubular-housing of each arm assembly is spaced from the outer end of the intermediate tube and from the outer end of the inner tube, wherein an input mixture input-flow-path communicates with a space between the intermediate tube and the inner tube of each arm assembly, wherein a heavy material output-flow-path communicates with a space within the inner tube of each arm assembly, and wherein a light material output-flow-path communicates with a space between the intermediate tube and the tubular-housing of each arm assembly, a method of mounting the inner ends of the tubular-housing, the intermediate tube and the inner tube of each arm assembly to a central member that rotates about the axis of rotation, comprising the steps of:

securing the inner end of the tubular-housing of each arm assembly to opposite sides of the central member,

providing a first mounting ring on the inner end of the tubular housing of each arm assembly, the first mounting ring having an inward-facing portion;

providing a second mounting ring on an inner end of the intermediate tube of each arm assembly, the second mounting ring having an inward-facing portion, and the second mounting ring having an outward facing portion secured to the inward-facing portion of the first mounting ring; and

providing a third mounting ring on an inner end of the inner tube of each arm assembly, the third mounting ring having an inward-facing portion secured to the outward-facing portion of the second mounting ring.

36. The method of claim 35 wherein and the outward facing portion of the second mounting ring physically underlies the inward-facing portion of the first mounting ring, and wherein the outward-facing portion of the second mounting ring overlies the inward-facing portion of the third mounting ring.

37. The method of claim 36 wherein the axis of rotation is a horizontal axis.

38. A system for oxidizing materials, said system comprising:

an entry zone;

a thickening zone;

a reaction zone;

a cooling zone; and

an exit zone.

39 The system in claim 38, wherein:

said entry zone is contained in a centrifuge influent manifold in a portion of a centrifuge arm adjacent to said influent manifold.

40. The system in claim 38, wherein:

said reaction zone is contained in an outer chamber of a centrifuge arm.

41. The system in claim 38, wherein:

said cooling zone is contained in a center channel of a centrifuge arm.

42. The system in claim 38, wherein:

said exit zone is contained in an effluent manifold in a centrifuge.

43. The system in claim 40, wherein:

a cooling tube injects cooling water into said reaction zone.

44. The system in claim 43, wherein:

said cooling tube can be manually adjusted along the length of said centrifuge arm.

45. The system in claim 43, wherein:

said cooling tube automatically adjusts in relation to the pressures within said cooling zone.

46. The system in claim 38, wherein:

an oxidant is injected into said reaction zone.

47. The system in claim 38, wherein:

a centrate flows out of said thickening zone.

48. A method for oxidizing materials, said method comprising the following steps

providing an influent material;

passing said influent material through an entry zone;

passing said influent material through a reaction zone;

passing said influent material through a cooling zone; and

passing said influent material through an exit zone.

49. The method in claim 48, wherein:

said entry zone is contained in a centrifuge influent manifold in a portion of a centrifuge arm adjacent to said influent manifold.

50. The method in claim 48, wherein:

said reaction zone is contained in an outer chamber of a centrifuge arm.

51. The method in claim 48, wherein:

said cooling zone is contained in a center channel of a centrifuge arm.

52. The method in claim 48, wherein:

said exit zone is contained in an effluent manifold in a centrifuge.

53. The method in claim 50, wherein:

a cooling tube injects cooling water into said reaction zone.

54. The method in claim 53, wherein:

said cooling tube can be manually adjusted along the length of said centrifuge arm.

55. The method in claim 53, wherein:

said cooling tube automatically adjusts in relation to the pressures within said cooling zone.

56. The system in claim 53, wherein:

an oxidant is injected into said reaction zone.

57. The system in claim 53, wherein:

a centrate flows out of said thickening zone.

58. An oxidation reactor for processing an incoming material, said reactor comprising:

a main body having at least one inlet and at least one outlet and being rotatable about an axis;

at least one hollow arm extending from said main body, said arm having a distal end and a proximal end, said arm defining at least an interior inlet flow path communicating with and leading from said inlet at said proximal end outwardly to said distal end, and at least a first exit flow path leading from said distal end to said

proximal end and communicating with said outlet, and a heat source at said distal end; and

a reactor region formed at said distal end of said arm.

59. An oxidation reactor as defined in claim 58, further comprising a flow path for inserting an oxidant into to said reactor region.

60. An oxidation reactor as defined in claim 58, further comprising:

a second exit flow path leading to a second outlet;

said first exit flow path for the flow of the incoming material after passing through said reactor region;

said second exit flow path for liquid separated from the incoming material.

61. An oxidation reactor as defined in claim 59, wherein:

said second outlet is closed.

62. An oxidation reactor as defined in claim 58, wherein:

said heat source is an electrode.

63. An oxidation reactor as defined in claim 58, wherein:

said heat source is a resistive heat element.

64. An oxidation reactor as defined in claim 58, wherein said heat source is an electro-magnetic heat source.

65. An oxidation reactor as defined in claim 58, wherein:

said heat source is capable of heating the reactor region to a temperature of approximately 705 degrees F.

66. An oxidation reactor as defined in claim 58, wherein said distal end is formed by a tubular end cap which encompasses the reactor zone.

67. An oxidation reactor as defined in claim 66 wherein said heat source at least in part surrounds said end cap.

68. An oxidation reactor as defined in claim 59, wherein said oxidant flow path outputs into to said reactor zone.

69. An oxidation reactor as defined in claim 68, wherein said oxidant flow path includes at least one separate injectors positioned in the outer wall of said arm.

70. An oxidation reactor as defined in claim 68, wherein said oxidant flow path extends interior to said arm to output into said reactor zone

71. An oxidation reactor as defined in claim 58, further comprising an auger positioned in said first exit path.

72. An oxidation reactor as defined in claim 71, wherein said auger forms a choke along its length to assist in controlling the pressure in the reaction zone.

73. An oxidation reactor as defined in claim 58, further comprising a probe positioned in said first exit flow path.

74. An oxidation reactor as defined in claim 73, wherein said probe defines a choke along its length to assist in controlling the pressure in the reaction zone.

75. An oxidation reactor as defined in claim 74, wherein said probe is adjustable along the length of said first exit flow path.

76. An oxidation reactor as defined in claim 73, wherein said probe is a fluid conduit and defines outlet apertures adjacent one end.

77. An oxidation reactor as defined in claim 71, wherein said probe is a fluid conduit and defines outlet apertures adjacent said choke.

78. An oxidation reactor as defined in claim 74, wherein said choke is an enlarged portion formed on a distal end of said probe.

79. An oxidation reactor as defined in claim 58, wherein said outlet is into a fluid.

80. An oxidation reactor as defined in claim 58, wherein said outlet is into a fluid in a closed container.

81. An oxidation reactor as defined in claim 80, wherein said fluid level in said container affects the back pressure applied to the reactor zone.

82. An oxidation reactor as defined in claim 80, wherein said closed container includes a gas layer above said fluid.

83. An oxidation reactor as defined in claim 25, wherein said fluid level can be adjusted in said container to increase or decrease the back pressure on the reactor zone.

84. An oxidation reactor as defined in claim 58, wherein said main body rotates about a vertical axis.

85. An oxidation reactor as defined in claim 84, further comprising a frame for suspending said main body in a manner to allow said main body to rotate about said vertical axis.

86. An oxidation reactor as defined in claim 85, further comprising a tank mounted to the bottom of said frame, into which said outlet extends.

87. An oxidation reactor for processing an incoming material, said reactor comprising:

a main body having at least one inlet and at least one outlet and being rotatable about an axis;

at least two opposing hollow arms extending from said main body, each of said arms having a distal end and a proximal end, said arm defining at least an interior inlet flow path communicating with and leading from said inlet at said proximal end outwardly to said distal end, and at least a first exit flow path leading from said distal end to said proximal end and communicating with said outlet, and a heat source at said distal end; and

a reactor region formed at said distal end of each of said arms.

88. A rotating centrifuge for performing an oxidation reaction on a sludge, the centrifuge comprising:

a housing having a central body and a hollow arm extending from said body, said arm having a first end attached to said central body, and a second end extending away from said central body, and an end cap attached to said second end of said arm to form a chamber in said arm, said distal end of said chamber being selectively heated;

a baffle attached to said body and extending into said chamber, said baffle having a longer inner tube having an interior and a distal end, and a shorter outer tube, said longer tube positioned inside said shorter tube and defining an inner space therebetween;

an outer space defined between said shorter tube and said hollow arm;

an entrance path for the mixture of initial material formed in said housing and communicating with said inner space;

a gas inlet channel in the centrifuge to diffuse gas into the heavier material;

an exit path for said light material formed in said housing and communicating with said outer space;

an exit path for said heavier material formed in said housing and including the interior of said longer tube; and

wherein a plug is formed in said chamber adjacent said end cap to engage said distal end of said longer tube and thereby define a flow path to guide said lighter material to said exit path for said lighter material, and said heat and combustible gas combining with the pressure on said heavier material to cause a oxidation reaction to occur.

89. An oxidation reactor for processing waste products comprising:

a centrifuge having a heated portion forming a reaction zone; and

a gas inlet to mix a gas with the waste product.

90. An oxidation reactor as defined in claim 89, wherein:

said centrifuge includes a housing having a central body and a hollow arm extending from said body, said arm having a first end attached to said central body, and a second end extending away from said central body, and an end cap attached to said second end of said arm to form a chamber in said arm, said distal end of said chamber being selectively heated to form the reaction chamber.

91. An oxidation reactor as defined in claim 90, further comprising:

a baffle attached to said body and extending into said chamber, said baffle having a longer inner tube having an interior and a distal end, and a shorter outer tube, said longer tube positioned inside said shorter tube and defining an inner space therebetween;

an outer space defined between said shorter tube and said hollow arm;

an entrance path for the mixture of initial material formed in said housing and communicating with said inner space;

a gas inlet channel in the centrifuge to diffuse gas into the heavier material;

an exit path for said light material formed in said housing and communicating with said outer space; and

an exit path for said heavier material formed in said housing and including the interior of said longer tube.